DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

National Institute for Occupational
Safety and Health
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati, OH 45226-1998

July 9, 2014
HHE 2014-0084

Mr. Matt LaVanchy
Assistant Chief
Pattonville Fire District
13900 Saint Charles Rock Road
Bridgeton, Missouri 63044

Dear Mr. LaVanchy:

We received a Health Hazard Evaluation (HHE) request from Mr. Harold Schaitberger, General President of the International Association of Fire Fighters (IAFF) on behalf of IAFF Local 2665. The request concerns the health and safety of Pattonville fire fighters when responding to emergencies at the neighboring Bridgton and West Lake Landfills.

We contacted you and learned that your specific concerns included the possibility of radiological exposure, appropriate response practices, and selection of personal protective equipment (PPE) when responding to emergencies related to a longstanding subsurface smoldering event (SSE) in the Bridgeton Landfill. You informed us of the Pattonville Fire Department response protocols and we reviewed an after action report from a response to an isolated incident at the Bridgeton Landfill on February 16, 2014. This letter summarizes our evaluation.

Background and Concerns:
The West Lake Landfill site is located in the East City Industrial Park in Bridgeton, Missouri in the St. Louis metropolitan area. This 214-acre site is located within the Missouri River floodplain. The Bridgeton Landfill is located within the West Lake Landfill site boundary, and is the central focus of this HHE.

The Bridgeton Landfill occupies about 52 acres of the West Lake Landfill site. Limestone quarrying and crushing took the land out of agricultural use beginning in 1939. The Bridgton Landfill is composed of a north and south quarry. The north quarry of the Bridgeton Landfill shares a border with one of two radiologically contaminated areas in the West Lake Landfill site. (See Enclosure 1 for landfill locations on the site.) Portions of the quarried and adjacent land areas received municipal refuse, industrial solid wastes, and construction and demolition debris starting in the early 1950s. Landfill operations in the state of Missouri were not subject to permitting prior to 1974. Quarrying ended in 1988 [U.S. EPA, 2008; Bridgeton Landfill, LLC. 2014a]. The Bridgeton Landfill was initially permitted in November, 1985 and stopped accepting

waste in December 2004. Additional background information on the West Lake Landfill site and Bridgeton Landfill is in Enclosure 1.

The West Lake Landfill site is on the U.S. Environmental Protection Agency (EPA) Superfund National Priorities List due to the presence of radiological wastes. Two separate areas within the West Lake Landfill site contain radiologically contaminated soil, referred to as radiologically impacted material (RIM). The two separate areas containing RIM make up the Superfund portion of the West Lake landfill site. These areas are designated as Area 1 and 2 of Operable Unit 1 (OU1(1) and OU1(2) in the Enclosure 1 figure) are fenced, restricted access areas. The closed Bridgeton Landfill site is owned by Bridgeton Landfill, LLC, whose parent company is Republic Services, Inc. Operable Unit 2 makes up the non-RIM identified area along the west side of the West Lake Landfill site in addition to the closed demolition landfill. Additional information on the configuration of the West Lake Landfill site and the location of the two RIM areas can be found in Enclosure 1.

Subsurface Smoldering Event:
On December 23, 2010, gas extraction wells in the south quarry of the Bridgeton Landfill indicated elevated internal temperatures. Bridgeton Landfill, LLC began testing landfill gas from the gas extraction system and found elevated hydrogen and carbon monoxide and reduced methane concentrations which typically indicate the presence of a subsurface smoldering event (SSE). In early spring 2012, subsidence levels began to exceed those normally expected and an increase in odors was affecting nearby residences and businesses. Investigation indicated the presence of an exothermic SSE in the south quarry [Engineering Management Support, Inc. 2014]. The SSE has advanced from the south quarry into the "neck" area of the Bridgeton landfill. The Bridgeton Landfill North Quarry Action Plan reports no evidence of an SSE in the north quarry at this time [Bridgeton Landfill, LLC. 2014a]. (See the location of these areas in the figure in Enclosure 1).

Radiologically impacted material:
Radionuclides are present in the upper 6 inches of surface soil in Area 1 of West Lake Operable Unit 1. RIM occurs at depths down to 7 feet, with some localized areas down to 15 feet. Radionuclides at the surface exceed the Uranium Mill Tailings Radiation Control Act standard for surface soil of 5 picocuries of activity per gram of material above background levels for about 1.2 acres of Area 1. (This area is within the West Lake OU1(1) disposal study area shown in the figure in Enclosure 1). The total volume of RIM soil and associated landfill materials is estimated at 24,400 cubic yards [Bridgeton Landfill, LLC 2014a].

Landfill management:
Bridgeton Landfill, LLC proposed installing a physical barrier between the north quarry and West Lake Operable Unit 1 Area 1 in September 2013. The proposal originally called for installing the barrier after trigger events, including the advancement of the SSE into the north quarry, occurred [Bridgeton Landfill, LLC 2014a]. The Missouri Department of Natural Resources (MDNR) hired a consultant to review the draft Bridgeton Landfill North Quarry Contingency Plan in July 2013. In the review, the consultant discussed the inadequacy of the

triggers [Thalhamer, Stark 2013]. The MDNR consultants noted that waiting to initiate the action plan until the trigger events had occurred would be too late to successfully implement the plan.

The U.S. EPA is still establishing the boundary of RIM between the north quarry and the West Lake Operable Unit 1 Area 1. Location of the isolation barrier and installation logistics were being discussed at the time of our evaluation. No date has been set to start construction.

The Bridgeton Landfill has a flexible membrane cap that covers the south quarry. Odors, gases, and vapors released from the south quarry are continuously collected by the landfill gas collection and control system and burned off at one of several flares. At the time of our evaluation, Bridgeton Landfill, LLC was installing a similar cap on the north quarry. Odors, gases, and vapors from the north quarry will connect into the gas collection and control system for the landfill [Bridgeton Landfill, LLC 2014a].

NIOSH evaluators learned that representatives from Bridgton Landfill, LLC no longer participate in weekly briefings regarding conditions in the landfill. These meetings were originally intended to provide emergency responders, such as Pattonville fire district, and the community with updates about the SSE, remediation progress, and various government agency actions. At the time of our evaluation, no direct line of communication existed between emergency responders and Bridgton Landfill, LLC.

NIOSH Response:
We contacted the IAFF Director of Occupational Safety and Health to obtain background information and to identify a contact with IAFF Local 2665 and the Pattonville Fire Protection District. With your assistance we identified contacts with the MDNR – Solid Waste Management Program and the U.S. EPA Region VII Office, and information resources specific to the West Lake Landfill Site. Multiple state and federal agencies have jurisdiction over the West Lake Landfill Site. The U.S. EPA is the lead agency for the West Lake Landfill Site Operable Unit 1, Areas 1 and 2 (the RIM contaminated areas). The MDNR is the lead agency for the Bridgeton Landfill and oversees environmental monitoring and the SSE. The Missouri Department of Health and Senior Services reviews air quality monitoring data collected by the MDNR.

We spoke with you on several occasions during March and April 2014 to gain a better understanding of the Pattonville Fire District's response patterns and working history with Republic Services, Inc. We learned that on February 16, 2014, the Pattonville Fire Department responded to a fire at the southern edge of the south quarry. We reviewed an after-action review of this response prepared by Republic Services and posted on their website [Bridgeton Landfill, LLC 2014b]. We have identified several potential hazards as well as planning issues that should be addressed.

We contacted the agencies involved with the Bridgeton Landfill to learn about current conditions and potential health hazards for fire department responders. The agencies we contacted included:

- MDNR – Solid Waste Management Program
- U.S. EPA, Region VII
- Occupational Safety and Health Administration Region VII and St. Louis Area offices
- Centers for Disease Control and Prevention – Agency for Toxic Substances and Disease Registry
- U.S. EPA Office of Research and Development - Engineering and Technical Support Center

We reviewed documents regarding the Bridgeton Landfill, the SSE, as well as the radiological hazards present in West Lake Operable Unit 1, Areas 1 and 2. These documents were published by or for the government agencies and were accessible online. The Republic Services website contains reports prepared for the MDNR and the Missouri State Attorney General's office (http://www.bridgetonlandfill.com/). The MDNR website document collection includes Missouri Department of Health and Senior Services reviews of air monitoring data, and daily and hourly air monitoring reports (http://www.dnr.mo.gov/env/swmp/facilities/BridgetonSanitaryLandfill-RCP.htm). We also reviewed a report prepared for the MDNR Solid Waste Management Program by a consultant with SSE expertise reviewing data from the Bridgeton Landfill SSE [Thalhamer 2013].

NIOSH Findings:

West Lake Landfill Site:

General landfill conditions and operations

- The type, amount, and location of refuse in the landfills are poorly defined.
- The Bridgeton Landfill has a liner, leachate collection system, gas extraction wells, temperature monitoring probes, gas collection and control system, flexible membrane cap, and flares to burn off collected gases. All of these components may be compromised by the SSE and landfill subsidence.
- The West Lake Landfill Operable Unit 1 has no leachate and gas collection systems.
- Republic Services will construct an isolation barrier below grade between the Bridgeton Landfill north quarry and the West Lake Landfill Operable Unit 1, Area 1. The Army Corps of Engineers will support the design and construction. U.S. EPA and MDNR are overseeing the entire process.
- The isolation barrier design and work plans must include provisions to manage materials excavated during construction, including screening materials for RIM prior to transport for storage or disposal. [Brooks 2014].

SSE

- SSE reaction activity is presently confined to the south quarry and portions of the "neck" area.

RIM

- RIM is believed to be limited to Operable Unit 1, Areas 1 and 2 of the West Lake Landfill.
- Operable Unit 1, Area 1 containing RIM adjacent to the north quarry is fenced and access is restricted.
- No buildings or work activities are located in Operable Unit 1, Area 1 other than site monitoring and characterization to define the boundary on the north quarry side.
- The potential for radon releases above background levels, migration of radionuclides in ground water, and future increases in radiological activity associated with the decay series of radionuclides in the RIM are of concern. Activities continue under the direction of the U.S. EPA to define the boundary of RIM from the West Lake Landfill Operable Unit 1, Area 1 and the north quarry.

Air monitoring activities, Bridgeton Landfill

- Results from area air monitoring for chemical contaminants were low or not detected.
- The Missouri Department of Health and Senior Services reviews air sampling data from the Bridgeton Landfill area for potential community public health concerns associated with short-term health effects.
- Carbon monoxide levels measured inside gas monitoring wells in the south quarry SSE area can exceed immediately dangerous to life and health levels (1,200 parts per million or greater).

Air monitoring activities, West Lake Landfill site

- The U.S. EPA is overseeing ground monitoring to identify the boundary of RIM from Operable Unit 1, Area 1 of the West Lake Landfill site adjacent to the north quarry.
- MDNR monitors for ambient gamma radiation and chemical contaminants (See Enclosure 2). The U.S. EPA Airborne Spectral Photometric Environmental Collection Technology unit flew over the West Lake Landfill site to take radiation and temperature measurements in March 2013.
- Radon and radionuclides could be released from the RIM to groundwater. [U.S. EPA – Office of Emergency Management, 2013].
- There is a potential for airborne release of radionuclides if the SSE enters landfill materials mixed with RIM in Operable Unit 1, Area 1. [Thalhamer 2014].
- The U.S. EPA is starting off-site air monitoring for particulates; alpha, beta, and gamma radiation; and volatile organic compounds to determine if installation of the landfill isolation barrier presents a risk to nearby residential areas [U.S. EPA 2014a].

Fire and rescue response procedures at the Bridgeton Landfill

- The surface fire response on February 16, 2014, was the first test of the Bridgeton Landfill Incident Management Plan.
- Communication between the Bridgeton Landfill facility coordinators and the emergency responders was incomplete and delayed.
- The Pattonville Fire District could not do an after-incident investigation into the February 16, 2014 fire because Bridgeton Landfill technicians buried the location with soil.

- The Pattonville Fire District sets up their incident command offsite and upwind from the landfill.
- Involvement of the fire department depends upon the Bridgeton Landfill facility coordinator's determination of the incident level. The St. Louis County Hazardous Materials Response team is available to the Pattonville Fire Distract for chemical and limited radiological hazard response needs. The Missouri National Guard Seventh Civil Support Team is also available for radiological response support.
- Potential hazards for first responders to the Bridgeton Landfill include the following:
    - landfill collapse (waste movement within the landfill footprint) or slope failure (waste movement outside the landfill footprint) exposing hot or burning waste
    - airborne contaminants from combustion of unknown subsurface landfill contents
    - SSE propagation to the surface
    - Potential radiation exposure in the event that the SSE reaches the RIM.

The incident management plan did not work well.

Incident management plan:

- The Incident Management Plan's stated purpose is to support the Bridgeton Landfill priority of promoting safety for the public, employees and contractors, and first responders [Bridgeton Landfill, LLC 2014b].
- The Incident Management Plan identifies three levels of response for surface and oxygenated subsurface fires; response level is determined by Bridgeton Landfill personnel (See Enclosure 3).

    - Surface fires identified as a Level 1-Incident do not require a fire department response; a Level 2-Emergency or a Level 3-Disaster require fire department notification.
    - Subsurface fires identified as Level 1-Incident or Level 2-Emergency do not require fire department involvement; a Level 3-Disaster requires fire department notification.
- MDNR requested an after-action review of the February fire.
- A preliminary after-action review prepared by Republic Services was posted on their website March 5, 2014 (https://media.gractions.com/1D7D52FB793099C6B609CBF1A9B8080234012AF5/9019d5d8-9269-4ebd-a466-b4bd2377acc5.pdf)
- The Incident Management Plan notes that it should and will be updated as time, circumstances and lessons learned necessitate.
- The Pattenville Fire District provided no input into the after action review.

Current Status:
The details of a proposed isolation barrier have not been determined. The purpose of the isolation barrier is to stop the SSE from entering Area 1 of Operable Unit 1. The isolation barrier gives the U.S. EPA time to study the best long-term solution.

Results from air monitoring from the Bridgeton Landfill and the SSE in the south quarry by the MDNR have not found elevated airborne contaminant levels. Area air monitoring done using summa canisters screening for volatile organic compounds as well as recent hourly monitoring for airborne chemical contaminants have not found elevated contaminant levels. The majority of the 62 volatile organic compounds tested by air monitoring were not detected [Eurofins Air Toxics, Inc. 2014a, 2014b].

The Pattonville Fire District routinely monitors for carbon monoxide, lower explosive levels, oxygen levels, and total volatile organic compounds when responding to landfill service response calls. They establish their incident command off-site and up wind until an incident specific technical briefing is received from the Republic Services facility coordinator or alternate coordinator. The incident response plans currently rely upon the landfill operator to determine incident status and whether outside assistance is required. (See Enclosure 3.)

The February incident investigation was handled internally by Republic Services. No final after-action review has been posted. We are unaware of any input being sought from the Pattonville Fire Department in their role as first responders for the after-action review. The Pattonville Fire District has access to the resources of the St. Louis County Hazardous Materials Response Team and the Missouri National Guard Seventh Civil Support Team to obtain additional technical assistance with incidents that may involve hazardous chemical releases or radiological materials.

It is unclear what impact an SSE would have on redistributing RIM into landfill leachate or the air. Uptake of radioisotopes by cover vegetation growing on Operable Unit 1 may provide another potential source for airborne radiological contamination if a surface fire developed from an SSE [Thalhamer 2014]. These concerns were not addressed in the report prepared by the Republic Services contractor evaluating possible impacts of a potential SSE on RIM in Operable Unit 1, Area 1 [Engineering Management Support, Inc. 2014].

Conclusions and Recommendations:
RIM associated with Operable Unit 1 has not been found in the portions of the Bridgeton Landfill experiencing an SSE. RIM may present an additional hazard if the SSE migrates into the landfill within the West Lake Landfill Operable Unit 1, Area 1, or the boundary between Operable Unit 1 and the Bridgeton Landfill north quarry. The potential for radiological contaminants to become airborne, either through the combustion of landfill wastes combined with the RIM or surface vegetation growing on RIM does not appear to have been evaluated.

The Pattonville Fire District is taking appropriate precautions when responding to fire calls at the Bridgeton Landfill. We did not identify any additional personal protective equipment that the Fire District should add for landfill responses.

On the basis of our findings, we recommend the actions listed below be taken during fire district response as well as those related to planning and communication. Organizations involved in incident responses involving the SSE in the West Lake Landfill site can best set priorities and assess the feasibility of our recommendations for the specific situations encountered.

Fire District Response:

1. Pattonville Fire District should continue:
    a. locating the staging area upwind when responding to incidents at the Westlake Landfill site
    b. precautionary monitoring to determine personal protective equipment requirements
    c. requiring a complete and current situation briefing from knowledgeable site personnel to determine a response
    d. wearing self-contained breathing apparatus (SCBA) until air testing indicates respiratory protection is no longer required.
2. Wear SCBAs during overhaul activities involving a fire at the landfill site until contaminant monitoring determines a lower level of respiratory protection provides adequate protection.
3. Do not drive emergency response equipment onto the landfill. Republic Services, Inc., and/or Bridgeton Landfill, LLC should provide the necessary equipment and machinery if the need to move onto the flexible membrane should arise.
4. Continue having the St. Louis County HAZMAT team on standby during a response.
5. Seek assistance from the Missouri National Guard Radiation Response team for their expertise in dealing with situations involving a potential radioactive release. This would apply to responses involving Operable Unit 1, Area 1 of the West Lake Landfill site.

Planning and Communication

6. Set up a communication/information sharing plan with Bridgeton Landfill, LLC so that information needed to protect responders can be rapidly obtained. This information includes, but is not limited to, recent monitoring well information, information regarding the landfill surface stability, and information regarding the leachate and gas collection systems.
7. A review and after-incident investigation should be conducted by the Pattonville Fire District promptly following their response to an event.
8. Revise the Pattonville Fire District's emergency response procedures based on what is learned from each after-incident review. Propose improvements to the emergency response procedures for all supporting agencies and responsible parties.
9. Maintain up-to-date contact information and communication channels between the first responders and all supporting agencies and responsible parties.

This letter closes our file on this health hazard evaluation request. NIOSH recommends that employers post a copy of this letter for 30 days at or near work areas of affected employees. A

copy of this letter is being provided to the Occupational Safety and Health Administration Region VII Office and the Missouri Department of Health and Senior Services.

Thank you for your cooperation with this evaluation. If you have any questions, please do not hesitate to call Steven Ahrenholz at (513) 841-4471 or Aalok Oza at (513) 841-4410.

Sincerely yours,

Steven H. Ahrenholz, PhD, MS, CIH
Senior Industrial Hygienist

Aalok Y. Oza, MPH
Industrial Hygienist
Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies

Enclosures 3

cc: Primary employee requestor
Occupational Safety and Health Administration Region VII Office
Missouri Department of Health and Senior Services
Chris Nagel, Missouri Department of Natural Resources
Harold A. Schaitberger, General President, International Association of Fire Fighters
Dennis Murray, President, IAFF Local 2665
Jeff Proctor, IAFF Local 2665

References:

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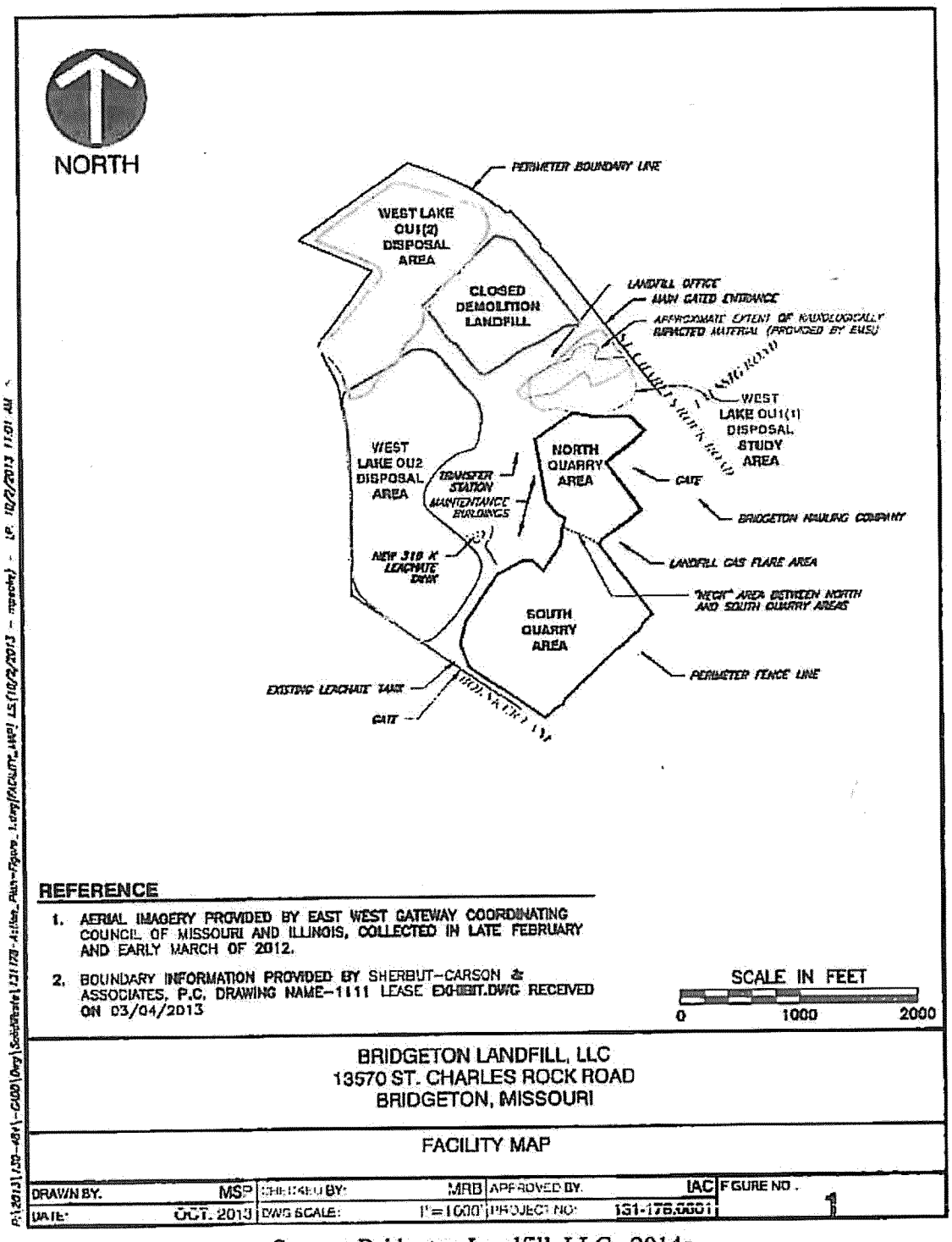
Enclosure 1

The West Lake landfill site has four distinct units:

- Operable Unit 1 (owned by Rock Road Industries, Inc.):
  - 8,700 tons of leached barium sulfate residues containing uranium, thorium, and long-lived decay progeny were mixed with 39,000 tons of soil and used for landfill daily groundcover operations in 1973.
  - Residues originated from uranium ore processing originally stored by the Atomic Energy Commission on land now occupied by the St. Louis Airport
  - Residues purchased by a private company for mineral recovery in 1966-7 placed in storage under an AEC license.
  - Operable Unit 1 is further divided into two geographic areas which operated as unregulated landfills prior to 1974:
    - Radiological Area 1: approximately 10 acres, contains municipal refuse, depth 15 feet shares a border with the north quarry portion of the Bridgeton Landfill.
    - Radiological Area 2: approximately 30 acres, contains construction and demolition debris, depth about 12 feet with some deeper spots is located in the northern part of the West Lake landfill site and is physically separate from Area 1.
  - EPA placed Operable Unit 1 on the Superfund National Priorities Lis in 1990
- Operable Unit 2:
  - Consists of inactive landfill cells
  - Contains sanitary wastes, other solid wastes and demolition debris, part of unregulated landfill operations operated pre-1974, does not contain radiologically contaminated soil
- Closed Demolition Landfill: (separately identified in figure below)
  - Received no radiologically contaminated soil, operated under state permit, closed 1995
- Bridgeton Sanitary Landfill (operated by Bridgeton Landfill, LLC, owned by Republic Services, Inc.): (separately identified in figure below as north quarry and south quarry)
  - Operated as a state regulated landfill from November 1985 until December 2004
  - 52 acre area consisting of two inactive solid waste landfill cells
  - A larger and deeper south quarry connected to smaller and shallower north quarry through a 300 foot wide and 250 foot deep "neck" area
  - Total waste thickness of 320 feet (approximately 240 feet below ground level (quarry depth) and an additional 80 feet above ground level [U.S. EPA Region 7, 2008; Bridgeton Landfill, LLC., 2014a].

Figure of West Lake Landfill Site



Source: Bridgeton Landfill, LLC., 2014a
Enclosure 2

Enclosure 2

The Missouri Department of Natural Resources (MDNR) provides continuous monitoring using an AreaRAE monitoring system at fixed locations for average and maximum values per hour of:

- carbon monoxide
- gamma radiation
- hydrogen sulfide
- lower explosive limit
- oxygen levels
- sulfur dioxide
- volatile organic compounds

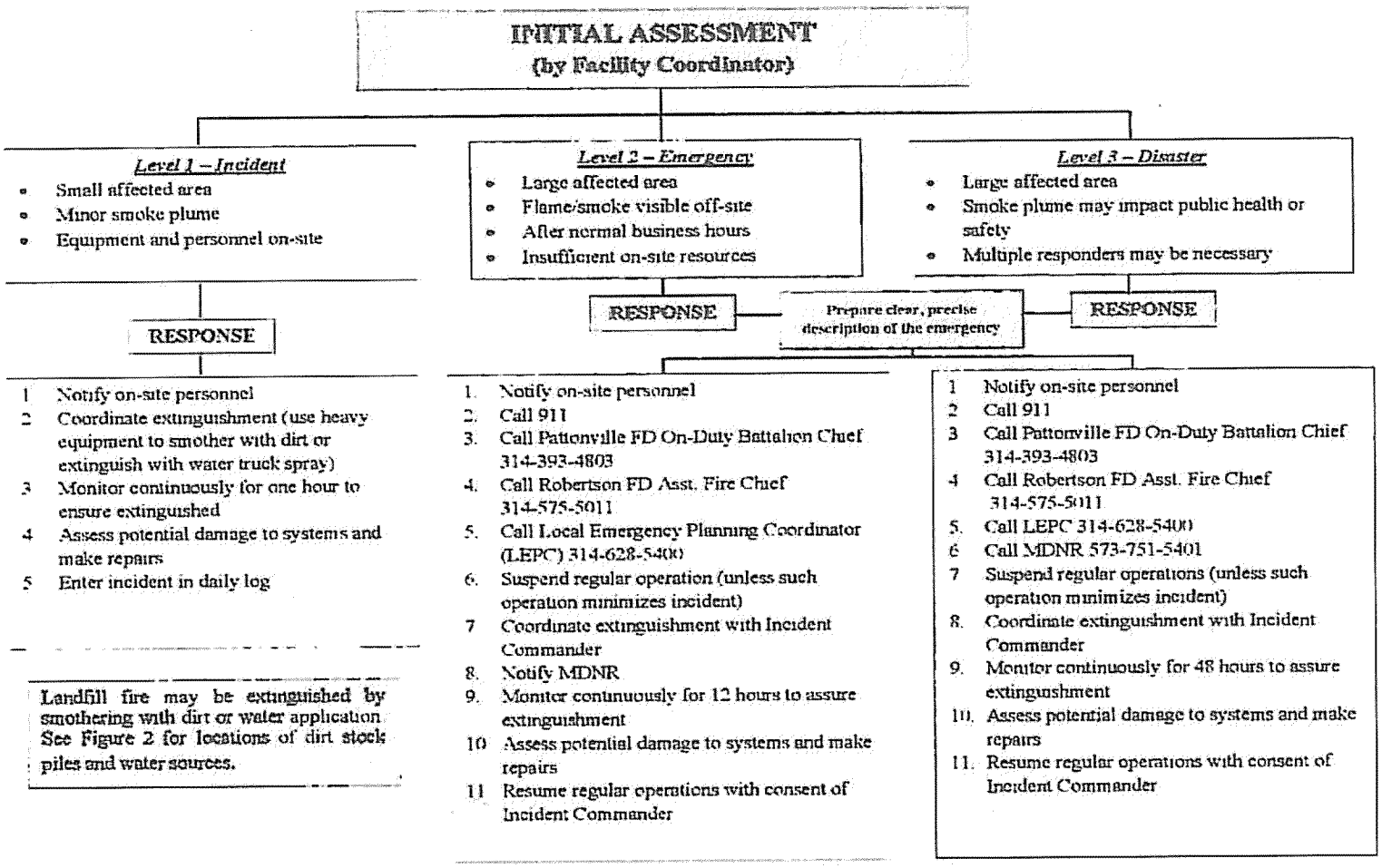
An example of this report may be found at:
http://www.dnr.mo.gov/bridgeton/docs/hourlyarearaesummary04242814.pdf
Hourly average meteorological data is also collected and reported.

Six liter Summa Canister samples are collected periodically by MDNR and submitted for laboratory analysis using a modified EPA Method for the determination of toxic organic compounds in ambient air, Compendium Method TO-15. This method analyses contents of the canisters using gas chromatography and mass spectroscopy. The method analyses for 62 organic compounds. All but a small number of the compounds were non-detectable for the latest samples [Eurofins air toxics report dated 4/12/2014, 20, & 22]. Compounds determined to be present in low (less than 5 parts per billion) concentrations were Freon 11, Freon 12, ethanol, acetone, 2-propanol, ethanol, methylene chloride, hexane, toluene, xylene, benzene, and acetone.[Eurofin Air Toxics, Inc. 2014a, 2014b].

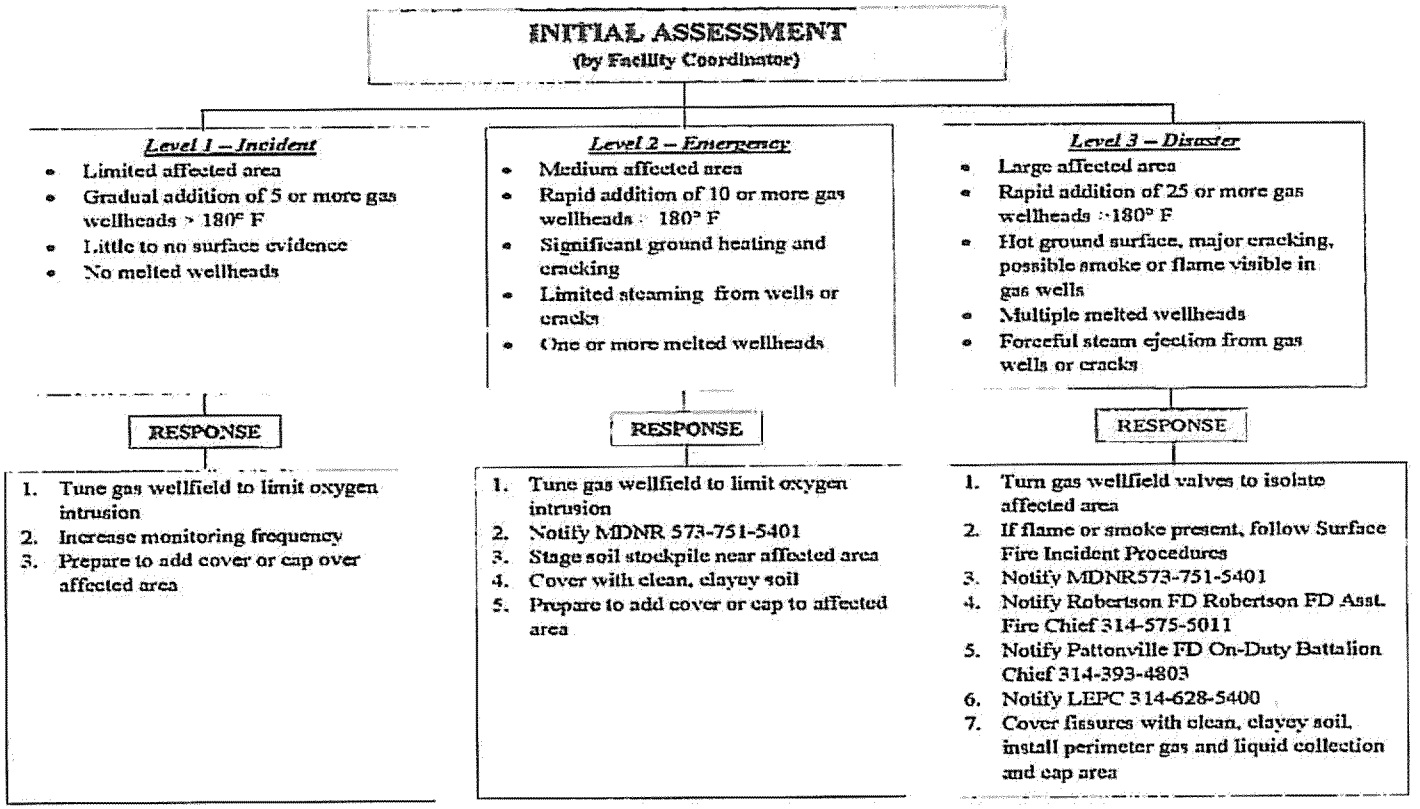
The Missouri Department of Health and Senior Services reviews air quality data and posts its interpretations on line at: http://www.dnr.mo.gov/env/swmp/facilities/BridgetonSanitaryLandfill-RCP.htm Levels reported are generally below those presenting a public health concern. Odorous compounds, which may be aesthetically objectionable, are also noted to occur as low concentrations. The Missouri Department of Health and Senior Services notes that previous sampling for odorous compounds have identified reduced sulfur compounds with a strong odor but lower toxicity [Missouri Department of Health and Senior Services, 2014]

Enclosure 3.

INCIDENT - SURFACE FIRE



INCIDENT – OXYGENATED SUBSURFACE FIRE (Subsurface Oxidation)



Source: Response and Incidence Strategies from Incident Management Plan, March 2013 (with updated responsibilities and contacts February 2014) [https://media.gractions.com/1D7D52FB793099C6B609CBF1A9B8080234012AF5/9019d5d8-9269-4ebd-a466-b4bd2377acc5.pdf]